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BATS OF THE GENUS CORYNORHINUS.

By GLOVER M. ALLEN.

WITH ONE PLATE.

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No. 9.— *Bats of the Genus Corynorhinus.*

BY GLOVER M. ALLEN.

INTRODUCTION.

SPECIMENS of the Big-eared Bats of the genus *Corynorhinus* have, until very lately, been few in museums, and most of those available to previous writers have been preserved in alcohol, so that they were of little value in determining color variation. The desirability of bringing together a large series of skins for comparison was emphasized twenty years ago by Miller (1897) in his review of the Vespertilionidae of North America, but no later attempt at a revision of the genus has been made. Thanks to the generous interest of Professor Theodore Lyman, the Museum of Comparative Zoölogy has lately acquired a small series of these bats from southeastern California, and the identification of these and other specimens in the Museum has induced me to undertake a general review of the genus. I have been fortunate in being able to assemble most of the skins and skulls available in American museums, some 126 specimens in all, covering practically the entire known range of these bats.

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of Milwaukee, Prof. Z. P. Metcalf of the North Carolina College of Agriculture, Prof. F. Payne of Indiana University, and Mr. M. L. Church of Marshall, N. C.

GENERIC AFFINITIES.

The Big-eared Bats of the genus *Corynorhinus* take the place of the Old World vespertilionine genus *Plecotus* in North America. In essential characters the two genera are very similar, and are evidently closely related. Miller (1907, p. 225) in his "Families and Genera of Bats" considers that "the great development of the glandular masses on muzzle, and the absence of the distinct lachrymal ridge, distinguish this genus sufficiently from *Plecotus*," to which LeConte and contemporary writers at first referred specimens. The shape of the nostrils is also diagnostic, but the presence of a distinct lachrymal ridge in a new species from Mexico (see p. 352), invalidates that character as distinctive of *Plecotus*. In 1864, Harrison Allen used *Synotus* of Keyserling and Blasius for the American bat, but in the following year he erected for it the new genus *Corynorhinus*, by which it continues to be known, although Dobson in his Catalogue of Chiroptera in the British Museum (1878) took the more conservative course of regarding it as a subgenus of *Plecotus*. The dental formula — $i \frac{2-2}{3-3}$
 $c \frac{1-1}{1-1}, pm \frac{2-2}{3-3}, m \frac{3-3}{3-3} = 36$ — is the same in both genera and shows but slight numerical reduction over that of *Myotis*, in the presence of two in place of three upper premolars on each side. In view of this somewhat primitive or unreduced tooth formula it is perhaps less surprising to find among the many specimens examined a single one with *three* upper incisors. This condition is perhaps to be considered reversionary to the more primitive state in which the full number of three upper incisors characteristic of placental mammals, is present. It has been generally assumed that it is the innermost upper incisor that was the first to be lost in all bats with two incisors, partly because of the "correspondence of the two upper teeth with the two outer of the lower jaw when the maximum set is present, and also, even more strongly, by the general tendency throughout the group for the premaxillaries to become reduced, particularly along the inner edge" which would "inevitably result in eliminating that part of the bone in which the first incisor grows" (Miller, 1907, p. 27). Andersen (1912, p. xxiv) without going further into the matter, asserts, however,

that the outermost incisor (i^3) is the one lost in all known Chiroptera. In the specimen of *Corynorhinus* mentioned (*C. m. townsendii*, Biol. Surv. Coll. 150273, from Happy Camp, California) it is evident from the agreement in form, that the two inner incisors correspond with the two normally present in the genus, and that the supernumerary one has been added at the *outer* side,—is in fact the i^3 usually missing in all living bats. In outline (Plate 1, fig. 1) this tooth is roughly a right-angled triangle with its height a little less than its base. It is a very little shorter than i^2 but much stouter, and with a long base, rather than with the terete form characteristic of the second incisor. In crown view it has a broad cutting edge, as broad as the crowns of the other incisors. The skull of the specimen is unfortunately in fragments, and the corresponding teeth of the left side are lost, but the remaining teeth are normal. The case is instructive as indicating not only that it is i^3 that has been lost in the Chiroptera, but that in this case, it was probably a larger tooth than i^2 which is retained.

GEOGRAPHIC DISTRIBUTION.

The general limits of distribution for the genus are now fairly well ascertained. In the East it has been reported from Micanopy, Florida, in the northern part of the peninsula, but to the southward of that point there are no records. Northward it occurs throughout Georgia and South Carolina, to western North Carolina and Virginia. West of the Alleghenies, the northward limit of the range includes Kentucky, southern Indiana, and west of the Mississippi swings north again to southwestern South Dakota and the Yellowstone Park in northwestern Wyoming. Between the Rocky Mountains and the Sierra Nevada the records are few, but the genus undoubtedly is found in southern Idaho and in Nevada. On the west coast, Vancouver Island, British Columbia, seems to be the northernmost limit, and thence it ranges south in the Sonoran zones, to the tableland of Mexico as far as Oaxaca and Vera Cruz. Apparently it has not yet been discovered in the peninsula of Lower California. In general it is characteristic of the Austral zones as defined by Merriam, though in the northwest, the subspecies *townsendii* is mainly confined to the Transition and even enters the Boreal zone. This more northward range in the northwest is possibly indicative of a more extended northward distribution in ancient times, when we may assume that

the ancestral stock was enabled to reach America from northeastern Asia by following land connections. In the particular accounts of the forms recognized in this paper, I have indicated more precisely the limits of distribution of each.

HABITS.

The Big-eared Bats are essentially cave-dwellers. In the West they frequently haunt the abandoned shafts and tunnels made by miners. Numbers of them may inhabit a single such tunnel, but they appear to rest singly, scattered along the rock walls, rather than in clusters. J. K. Townsend (1839) in the journal of his expedition to the Columbia River, Oregon, in 1834, relates that they often lived in the storehouses at the forts, and were considered by the fur traders to be beneficial in ridding such places of *Dermestes*.

There is no evidence to indicate that any of the forms are migratory. In the northern part of their range they retire to suitable caverns to hibernate. Hahn (1909) records finding specimens in caves at Mitchell, Indiana, during the winter of 1906-7 and Butler (1895) obtained two from Greencastle, Ind., 23 December, 1894. Brimley (1905) reports one taken 1 February, 1893, in Bertie Co., North Carolina. The University of Colorado has two from Boulder County in that State, captured in mid-winter, one on 21 January, 1912, in a mine-tunnel where the temperature was 48° F., the other on 23 February, 1910, in a tunnel at fifty feet from the surface (altitude 7760 feet).

The young are probably born in early July or even earlier in the southern part of the range. Stephens (1906, p. 265) records a female of *C. m. pallescens* captured at San Diego, California, on 25 April, that contained a single foetus. In the San Jacinto Mts., of Southern California, Grinnell and Swarth (1913, p. 379) collected a female containing a single large foetus about 5 June. They found that the adult bats in a resting posture folded the long ears back against the sides, close to the body, a habit which Hahn (1909) seems to have been the first to record in the case of specimens from Indiana. In a freshly killed specimen, however, the ears project forward.

HISTORY AND NOMENCLATURE.

What is perhaps the first mention of a bat of this genus, is found in Clapton's (1722, p. 594) account of the animals and other products of

Virginia. Among mammals, he lists "*Bats*, as I remember, at least two sorts; one a large sort with *Long Ears*, and particularly long straggling *Hairs*; the other much like the *English*, something larger, I think, very *Common*." The long ears of the first sort may perhaps identify it with *Corynorhinus*; the other was possibly an *Eptesicus*. It was not until 1818, however, that the naturalist Rafinesque named and briefly described *Vespertilio megalotis* from a specimen captured somewhere on "the lower parts of the Ohio" River, the Wabash, or the Green River, perhaps in Indiana. His name, which I think must hold for a bat of this genus, has been generally ignored in favor of LeConte's later name *Plecotus macrotis* based probably on specimens from Georgia. A study of the large number of skins which I have been able to assemble from many parts of the range of the genus shows, rather unexpectedly, that the bat of the eastern United States west of the Alleghenies is quite different from the dark brown, white-bellied animal of the south Atlantic and Gulf States, to which the name *macrotis* strictly applies. In the species inhabiting the interior and western parts of the United States, the contrast in color between the tips and the bases of the hairs of both surfaces is not abrupt as in *macrotis* but passes imperceptibly from a dark base to a differently colored tip, nor are the hairs of the lower surface tipped with pure white. To this species, Rafinesque's name must apply. West of the Mississippi, this species gradually becomes paler, and over the Rocky Mountain area and the Southwest is a dull buffy color. To this race of *megalotis*, Miller's (1897) name *pallescens* applies. On the humid northwest coast, a gradual darkening takes place, and a strongly marked subspecies is again recognizable, to which the name *townsendii* was given by Cooper in 1837. On the Mexican tableland, the same type of bat is found, but of a dark smoky hue and slightly reduced proportions, which I here describe as new. Apparently the white-bellied *Corynorhinus macrotis* of the Atlantic slope and Gulf States as far west at least as Louisiana, does not intergrade with the differently colored representatives to the West, and I am therefore provisionally regarding it as a distinct species. Still a third species, with very large and differently formed ears and peculiar skull is represented by a single specimen from central Mexico, and has remained hitherto undescribed. The brief synonymy given under each name in the descriptions which follow, indicates sufficiently the opinions of previous writers as to the nomenclature of this genus.

CORYNORHINUS MEGALOTIS (Rafinesque).

Rafinesque's Big-eared Bat.

Vespertilio megalotis Rafinesque, Amer. monthly mag., 1818, 3, no. 6, p. 446.

Plecotus rafinesquii Lesson, Manuel de mammalogie, 1827, p. 96. (Renaming of Rafinesque's *V. megalotis*).

Corynorhinus macrotis Miller, N. Amer. fauna, 1897, no. 13, p. 51 (? in part, Kentucky specimen cited).

Type.—None specified, and original specimens not known to be extant.

Type Locality.—"The lower parts of the Ohio" River, probably in southern Indiana and Illinois or western Kentucky in the region between the Wabash and the Green Rivers.

Distribution.—Central eastern United States from extreme western Virginia, through Kentucky, southern Indiana and Illinois, to Kansas, intergrading with the race *pallescens* to the westward.

General Characters.—Largest of the *megalotis-macrotis* group; bases and tips of hairs, above and below, not strongly and sharply contrasted in color.

Color.—Adults: bases of the hairs, on dorsal surfaces of the body, gray or slaty gray shading by imperceptible degrees into a 'wood brown' (Ridgway, 1912) at the sides, and a 'clove brown' over the median area of the back. The amount of 'clove brown' wash over the back varies slightly in individuals, but conduces to a much darker, more drabby appearance than is found in typical *pallescens*. Downy hairs at the bases of the ears posteriorly are whitish. Ventral surfaces 'pale pinkish buff,' the bases of the hairs shading into grayish.

Immature specimens (No. 157075 Biol. Surv. Coll., Burke's Garden, Va., 7 August, 1908), are uniform dark 'hair brown' to 'fuscous' above to the bases of the hairs; below, pale 'hair brown' the hair along the sides and on the belly paling at the tips to a dirty whitish. Compared with immature *pallescens*, it is more uniformly dark, lacking the light buffy admixture. It is also darker and larger than the Mexican race.

Skull.—The skull is largest of all the *megalotis-macrotis* group, with broad depressed rostrum, and large brain case. The intermaxillary notch viewed from above is rather larger with wider-bowing sides than that of *macrotis*. The inner upper incisor is usually without trace of a secondary outer cusp, though in one of four specimens from

Burke's Garden, Virginia, a cusp is barely indicated by a minute shoulder. In *macrotis* this cusp is normally well developed.

Measurements.—No. 157076, Biol. Surv. Coll., from Burke's Garden, Bland County, Virginia: forearm 45 mm. (average of three adults 44.1); digit III, metacarpal 39.8; first phalanx 13.8; second phalanx 19; tibia 19. Collector's measurements: total length 107 mm., tail 49; hind foot 12; extent of wings 320.

Skull: greatest length 17.4 mm.; basal length 14; palatal length 8; zygomatic breadth 9; interorbital constriction 4; mastoid breadth 9.2; width of braincase 8.6; upper tooth row 6.7; lower tooth-row 7.3.

Remarks.—The discovery of a *Corynorhinus* distinct from *C. macrotis*, from extreme western Virginia, westward, in the eastern United States was wholly unexpected. It is the eastern representative of the desert-colored *pallesceus* of west-central United States, from which it chiefly differs in its somewhat darker, more drab, coloration. The skull is a trifle larger as well. I have applied to it Rafinesque's name *megalotis*, based on specimens which he collected from "the lower parts of the Ohio" River probably in southern Indiana or western Kentucky, where the genus is known to occur at the present time (see Cory, 1912, p. 476). Rafinesque's description is brief, yet I think unmistakable in the light of our present knowledge. Nevertheless, Miller, in 1897, rejected his name as unidentifiable and applied Le Conte's later name, *macrotis*, to the species of *Corynorhinus* in eastern North America. The discovery of a species in the interior distinct from *macrotis* makes it necessary either to erect a new name or to recognize *megalotis* as applicable to it, and this latter course I propose to adopt. In 1818, Rafinesque sent to the editors of the American Monthly Magazine brief accounts of the animals he discovered in the course of his journey "through the western region of the United States," and gave new names to many of these. In one of these communications written in October, he gave a brief statement of certain supposed new species obtained since July, during which time he says, he had visited "the lower parts of the Ohio, the Wabash, Green River, Barrens, Prairies, and the states of Indiana, Illinois, &c." This is the general locality whence he obtained the new bat which he describes as follows: "9. *Vespertilio megalotis* R. (Big-eared Bat.) Tail three-eighths of total length, body dark gray above, pale gray beneath, ears very large, duplicated, auricles nearly as long. Length 4 inches, breadth 12 inches."

The evident similarity to the Old World *Plecotus*, led Lesson in 1827 to change the genus and (as the custom then was) the specific

name as well, calling it *Plecotus rafinesquii*. The description of the color ("dark gray above, pale gray beneath") though inexact, is certainly applicable to the present form and not at all to *macrotis*. The statement that the ears are "duplicated" is descriptive of the manner in which the inner rim folds upon the rest of the conch, and will apply to no other of the eastern genera with which he could have met, except possibly the very different *Nyctinomus*; in which the "auricle" [i. e. tragus] is not "nearly as long." Even in *Corynorhinus* the tragus is hardly more than half the length of the ear. The measurements given,— "length 4 inches [= 101.5 mm.], breadth 12 inches [= 304.5 mm.]" are not far from those of the Virginia specimens (lengths 107, 108, 110; extent 320, 313, 313) allowing for differences in manner of taking these dimensions. The tail is nearer one half than three eighths of the total length. In spite of slight discrepancies, I think the description can apply to no other bat of the eastern United States. The very name is diagnostic. When LeConte proposed the name *Plecotus macrotis* for the Big-eared Bat of the coast States, he acknowledges its similarity to the species of the interior, by his remark in a footnote: "There is another species with equally long ears, which are not united on the cranium; which of these is the *megalotis* of Raffin., it is impossible to say." In view of these facts, I think the propriety of using Rafinesque's name is no longer open to question.

West of the Mississippi, typical *megalotis* (of which in lack of topotypes I have assumed the Virginia specimens to be representative) grades by insensible degrees into the more buff-colored subspecies *palleseens*, and the latter again shades rather abruptly into the dark-colored *townsendii* of the humid Pacific coast area. Two specimens from Sun City, south central Kansas, in the Biological Survey Collection, though not as dark as the Virginia *megalotis* are better referable to it than to *palleseens*. Specimens from eastern and central Colorado are intermediate, but on the whole, nearer *palleseens*. To the southward as well as to the north, the limits of the range remain to be more carefully worked out.

Many years since, Dr. Harrison Allen (1864, p. 64) recorded on the authority of Professor Baird, "that specimens of a *Synotus*, probably of this species [i. e., *macrotis*], were received some years ago by the Smithsonian Institution, from Meadville," Crawford County, northwestern Pennsylvania. The specimens have been lost and no subsequent captures of this bat have been made in the State. The record, though discredited by Rhoads (1903, p. 226) may nevertheless be

valid, and if substantiated, would fix nearly the northern limit for the species in the east. It is not known that the genus ranges farther north than Virginia on the eastern side of the Alleghanies, though to the westward of that range its presence at a more northerly latitude is well known.

Specimens examined.—Eight from the following localities:

Virginia: Burke's Garden, 4 (Biol. Surv.).

Kansas: Sun City, 2 (Biol. Surv.).

Colorado: 12 miles south of Lyons, Boulder Co., 1 intermediate (Univ. of Colo.); Crisman, Boulder Co., 1 intermediate (Univ. of Colo.).

Additional locality records, probably referring to this bat, are: Indiana, Greencastle (Putnam Co.) (see Cory, 1912, p. 476); Kentucky, Bowling Green (Miller, 1897).

CORYNORHINUS MEGALOTIS PALLESCENS Miller.

Pallid Big-eared Bat.

Synotus townsendi H. Allen, Smithsonian misc. coll., 1864, 7, p. 65 (not of Cooper, 1837).

C[orynorhinus] townsendi H. Allen, Proc. Acad. Nat. Sci. Phila., 1865, p. 175 (? not of Cooper, 1837).

Corynorhinus townsendii H. Allen, Bull. 43, U. S. N. M., 1893, p. 58, (not of Cooper, 1837).

Plecotus (Corinorhinus) townsendi Trouessart, Cat. Mamm., 1897, fasc. 1, p. 105 (in part).

Corynorhinus macrotis pallescens Miller, N. Amer. fauna, 1897, no. 13, p. 52, fig. 10.

Type.—Skin and skull 65534, U. S. N. M. (Biological Survey Collection), adult female, collected 3 August, 1894, by A. K. Fisher.

Type Locality.—Arizona: Navajo County, Keam Canyon.

Distribution.—Western United States from western Texas, Colorado, and southwestern South Dakota, to the Pacific coast of southern California. Typical *pallescens* may yet be found to occur in northern Mexico, but none have been examined from there.

General Characters.—Similar to typical *megalogotis* but slightly smaller; colors paler, more buffy throughout.

Color.—Adult: no sharp contrast in color between bases and tips of hair. General effect of an average specimen (Prescott, Ariz.)

'pinkish buff,' the hairs paling on their middle third and darkening by imperceptible degrees to gray or slate gray at their extreme bases. Downy hairs at the posterior bases of the ears whitish. Below, the general appearance is 'pale ochraceous buff,' the hairs darkening gradually toward their bases to a neutral gray, except in the middle region of the throat, where usually the hairs are not perceptibly darker at base.

Immature specimens have the pelage more dusky throughout than the adults. The basal two thirds of the hairs above is nearly 'neutral gray' with short pale tips of buffy, nearly 'vinaceous buff.' Below, the color is paler, the light tips of the hairs a soiled whitish.

Color Variation.— In a large series of skins that may fairly be taken to represent *pallescentis*, there is much individual variation in the intensity of coloring among adults. A specimen from Ash Creek, Graham Mts., Arizona (204375 Biol. Survey Coll.) has the basal halves of the hairs 'slate color' producing an effect much darker than usual. It may be considered a step in approach to the dark subspecies of the Mexican highlands. Two specimens (10694, 10695 Univ. of California Coll.) obtained by Dr. Joseph Grinnell at Riverside Mountain, Colorado River, southeastern California, are the brightest colored individuals I have seen, with a distinct reddish cast to the upper surface, nearly 'vinaceous cinnamon,' shading into a 'buff pink' below, the bases of the hairs only slightly darkened. The palest specimen of all is one collected in the hills back of Lone Pine, California, by Dr. Theodore Lyman's expedition of 1915. It is 'pale pinkish buff' above and nearly white below to the roots of the hairs. Apart from these slight variations *pallescentis* is remarkably uniform in tint over a wide range of territory.

Skull.— The skull of this race is hardly to be distinguished from that of true *megalotis*. To the eye, it seems a trifle narrower across the rostrum but the difference is not clearly brought out by measurements. The upper inner incisor is normally without the lateral cusp characteristic of *macrotis*.

Measurements.— No. ⁹⁹³⁴/₈₂₆₅, Coll. Amer. Mus. Nat. Hist., from Prescott, Arizona: forearm 43 mm. (average of four Arizona specimens 42.6); digit III, metacarpal 37.3 (average of four 37.5); first phalanx 13 (average of four 13); second phalanx 16 (average of four 17.2); tibia 18. Collector's measurements, No. 204375, Biol. Survey Coll., Graham Mts., Arizona, total length 102 mm.; tail 50; foot 9; extent of wings 300.

Skull: No. 204375 Biol. Survey Coll., Graham Mts., Arizona:

total length 16 mm.; basal length 13; palatal length 7.3; zygomatic breadth 8.5; interorbital constriction 4; mastoid breadth 9; width of braincase 8; upper tooth-row 6; lower tooth-row 6.5.

Remarks.—The subspecies *pallesceus* is characteristic of the arid and desert country of western United States as far north at least as southern South Dakota. Its pallid buffy coloration recalls that of other mammals that dwell in a dry open country. Its intergradation with true *megalotis* to the eastward seems to be very gradual, but in the northwest as it enters the humid coastal area from western and northern California, to southern British Columbia it merges rather abruptly into the darker *townsendii*. In the southwest, it appears to range as far east as the Pecos River in Texas and probably intergrades in northern Chihuahua with the darker race of the Mexican plateau. All the specimens that I have seen from Arizona and southern California, however, seem referable to *pallesceus*.

The line of intergradation with *townsendii* seems to follow the Sacramento Valley of California back of the coast range from a short distance to the south of San Francisco about as far north as Placer County, where the change comes rather abruptly. The name *intermedius* H. W. Grinnell was based on specimens from Auburn, in this County, but to my mind there is hardly room for the recognition of an additional race. The type is well within the range of variation of *townsendii*, while other specimens from the same locality are quite as pale as some specimens of *pallesceus*. Further records for central and eastern California and for the states to the eastward are to be desired.

Specimens examined.—Fifty-seven, from the following localities:

Arizona: Fort Verde, 1 (Amer. Mus. Nat. Hist.).

Graham Mts., 1 (Biol. Surv.).

Pinal Co., 1 (Amer. Mus. Nat. Hist.).

Prescott, 1 (Amer. Mus. Nat. Hist.).

California: Auburn, Placer Co., 2 not typical (Univ. of Calif.).

Julian, San Diego Co., 1 (Univ. of Calif.).

Kenworthy, San Diego Co., 12 (Univ. of Calif.).

Lone Pine, Inyo Co., 4 (M. C. Z.).

Los Angeles, 1 (Pub. Mus. Milwaukee).

Oro Grande, San Bernardino Co., 2 (Biol. Surv.).

Riverside Mt., Colorado River, 2 (Univ. of Calif.).

Vallecito, San Diego Co., 2 (Univ. of Calif.).

Whitewater, Riverside Co., 1 (Univ. of Calif.).

Colorado: Boulder Co., 2, not typical (Univ. of Colo.).

Wyoming: Mammoth Hot Springs, 4 (Biol. Surv.).

Wyoming: Sand Creek, 10 miles east of Sundance, 10 (Biol. Surv.).

South Dakota: Cheyenne River, 3 (Amer. Mus. Nat. Hist.).

Custer, 7 (Biol. Surv.).

Miller and others have recorded *pallescens* from the following additional localities:

Arizona: Fort Huachuca; Keam Canyon, Navajo Co. (type locality).

California: Dulzura; Owens Lake; Owens Valley; San Diego.

Colorado: Larimer County.

Texas: East Painted Cave, near mouth of Pecos River.

Utah.

CORYNORHINUS MEGALOTIS TOWNSENDII (Cooper).

Townsend's Big-eared Bat.

Plecotus townsendii Cooper, Ann. Lyc. nat. hist. N. Y., 1837, 4, p. 73, pl. 3, f. 6.

Plecotus macrotis Dobson, Cat. Chiroptera Brit. mus., 1878, p. 180 (not of LeConte, 1831).

Plecotus (Corinorhinus) macrotis Trouessart, Cat. Mamm., 1897, fasc. 1, p. 105 (in part).

Corynorhinus macrotis townsendii Miller, N. Amer. fauna, 1897, no. 13, p. 53, f. 8, a, a'; 9, a, a'.

Corynorhinus macrotis intermedius H. W. Grinnell, Univ. Calif. publ. Zool., 1914, 12, p. 320.

Type.—None specified. The original three specimens are not known to be still in existence.

Type Locality.—Oregon, on the lower Columbia River. Townsend, (1839, p. 325) who collected the types, says that they frequent "the store houses attached to the forts" hence it is probable that since The Dalles, Fort Walla Walla, Vancouver, Fort George, and Astoria, were the forts visited, one of these furnished the three skins he collected.

Distribution.—The humid coast region from Vancouver Island, British Columbia, southward to San Francisco, California, intergrading with *pallescens* here, as well as in north central California. Inland it extends over most of (?) Washington, Oregon, and the western half of northern California.

General Characters.—A dark-colored race, characterized by the blackish bases of the hairs, with contrasted brown tips above, and pale brown wash below.

Color.—Adults: general effect above a uniform 'warm sepia.' The basal half of the hairs is dark slaty in strong contrast to the terminal half or third which is nearly 'snuff brown.' Downy hairs at the posterior bases of the ears and on their anterior rim, whitish. Below, the rich brownish of the back passes gradually into a wash of pale wood brown, nearly 'avellaneous' (Ridgway, 1912). All the hairs of the ventral surface are 'blackish plumbeous' in the basal half.

Immature specimens (76250 Biol. Survey Coll., from Comox, B. C.) are darker, the hairs nearly uniform blackish plumbeous, with a faint brown tipping, above. Below, the pale tips of the hairs are more noticeable, and the coloring is much as in the adult, though lacking the warm brownish or russet wash.

Skull.—No tangible differences can be made out that will distinguish the skull of *townsendii* from that of *pallescens*. As in the latter the second lower premolar is frequently drawn in from the axis of the tooth-row and the inner upper incisor is normally unicuspidate. In two specimens examined, however, the latter tooth has a distinct shoulder or incipient cusp (204435, 76250 Biol. Survey Coll.). Compared with *C. macrotis* the profile of the skull is more abruptly elevated from the rostrum.

Measurements.—No. 9744 Field Mus. Nat. Hist. from Goldbeach, Oregon: forearm 43 mm. (average of ten Oregon specimens 42.0); digit III, metacarpal 38 (average of ten Oregon specimens 38.4); first phalanx 12.8 (average of same ten 12.7); second phalanx 16 (average of same ten 16.8). Collector's measurements: total length 111 mm.; tail 47; hind foot 12; ear 36.

Skull: greatest length 16.2 mm.; basal length 13.5; palatal length 7.5; zygomatic breadth 8; interorbital constriction 4; mastoid breadth 9; width of braincase 8; upper toothrow 6.3; lower toothrow 7.

Remarks.—This dark brownish race is characteristic of the humid coastal area of western North America from southern British Columbia southward to the region of San Francisco, California. Inland from the coast ranges and to the south and east of San Francisco the increasing aridity causes a progressive decrease in the amount of dark pigment so that complete intergradation by imperceptible degrees takes place with the interior subspecies *pallescens*. Specimens from intermediate localities can usually be referred to one or the other, however, though occasional individuals are strictly intermediate. A skin from Mt. Veeder, Napa County, just north of San Francisco, is

indistinguishable from typical *townsendii*. Another from Bear Valley, San Benito County, to the south of that place, is nearly as dark, yet a shade paler. Through the kindness of Dr. Joseph Grinnell and Mr. H. S. Swarth of the University of California, I have had for examination a very interesting series of nine skins from Auburn, Placer County, north central California, at the semi-arid western foot of the Sierra Nevada. Two of these are in dark immature pelage. Two others (7755, 19214) agree perfectly with specimens of *pallescens* from Arizona or Wyoming, though the bases of the hairs are a trifle darker than the average of that subspecies. Four, though of a richer brown than *pallescens* are yet not quite so dark as typical *townsendii* of the humid coastal area. Nevertheless they are nearer to the latter than to *pallescens*. The remaining specimen is indistinguishable in any essential particular from *townsendii* of the Oregon coast. This last example served as the type of *C. macrotis intermedius* Hilda W. Grinnell. With the advantage of more abundant material and after careful consideration, I feel unable to concur with Mrs. Grinnell in regarding these specimens as representing a recognizable race. They are clearly intermediate between *pallescens* and *townsendii*; the type can be absolutely matched by Oregon specimens of the latter, while others again, from the same locality, might without violence be referred to the former. In other words, a series of topotypes shows no characters by which they may constantly be distinguished from the two neighboring races over any considerable area. The same series was originally referred to *townsendii* by Dr. Joseph Grinnell, and the specimens are on the whole best considered as representatives of that subspecies, with a tendency toward the pallid form of the interior. The same is true of specimens from Happy Camp (Siskiyou Co.) and Bear Valley (San Benito Co.), referred by Mrs. Grinnell to '*intermedius*.' A single skin (6957 Univ. of Cal., Mus. Vert. Zool.) from Johnson's Harbor, Santa Catalina Island, California, though much too dark to be typical of *pallescens* is not so dark as typical *townsendii*. Though an intermediate specimen in color, it may for the present be considered nearer the latter. The record is of interest in connection with the occurrence of other small land mammals on this island, some of them distinct insular representatives of continental species.

Specimens examined.— Including intermediate specimens, which are nearer *townsendii* than *pallescens*, twenty-three from the following localities:

British Columbia: Comox, 1 (Biol. Surv.).

Oregon: Gold Beach, 6 (Field Mus. Nat. Hist.).

McKenzie Bridge, 3 (Biol. Surv.).

Vida 1 (Biol. Surv.).

California: Mt. Veeder, Napa Co., 1 (Biol. Surv.).

Bear Valley, San Benito Co., 2 (Biol. Surv.).

Happy Camp, Siskiyou Co. (Biol. Surv.).

Auburn, Placer Co., 7, not all typical (Univ. of Calif.).

Santa Catalina Id., 1, not typical (Univ. of Calif.).

Miller has also recorded it from Creswell, Oregon.

CORYNORHINUS MEGALOTIS MEXICANUS, subsp. nov.

Mexican Big-eared Bat.

Plecotus (Corynorhinus) townsendi J. A. Allen, Bull. Amer. mus. nat. hist., 1890, 3, p. 176 (not of Cooper, 1837).

Corynorhinus macrotis pallescens Miller, N. Amer. fauna, 1897, no. 13, p. 52, f. 10 (in part — Mexican specimens cited).

Type.—Skin and skull, 98285, Biological Survey collection, adult female, collected by E. W. Nelson and E. A. Goldman, 25 Aug., 1899.

Type Locality.—Mexico: Chihuahua, near Pacheco.

Distribution.—The Mexican tableland, from central and western Chihuahua, southward to Oaxaca and Santa Cruz; the precise limits are not yet fully ascertained.

General Characters.—Smallest of the *megalotis-macrotis* group, the skull small with weak canines, a short and contracted rostrum with evenly tapering lateral outlines as seen from above; color dark, the hairs nearly uniform drab throughout.

Color.—Adult in summer; above, a nearly uniform 'drab,' the bases of the hairs hardly at all darker than their tips; below, the terminal third of the hairs is soiled whitish, the bases becoming gradually darker, nearly fuscous or 'benzo brown.' At the throat the dark bases show through more than elsewhere. In fall, the pelage is longer and more silky, with slightly more contrast between the tips and the bases of the hairs, the latter now decidedly darker, shading into a pale 'hair brown.' The hairs of the lower surface are tipped with a clearer whitish, washed with pinkish buff. In this pelage they approach the coloration of typical *megalotis* of the eastern United States.

Skull.—The small delicate skull is notable for its weak canines, the short and contracted rostrum. In the other races of this group the roots of the upper canines cause a distinct bulge in the outline of the snout as viewed from above, but in these small Mexican bats the gently convex and tapering outline is not noticeably interrupted. In contrast with the other races of *megalotis* the inner upper incisor is normally provided with a distinct pointed cusp at its outer side. This cusp is wanting in but one (91930, Biol. Surv. Coll.) among eighteen skulls from Mexico that I have examined. Mr. G. S. Miller, Jr., (1897, p. 53, fig. 10) records variation in respect to this cusp in a series from Guanajuato, in which both extremes of development are represented. The small size of the skull, and the short tapering rostrum distinguish it at a glance from *macrotis*.

Measurements.—The type measures: forearm 39.4 mm. (average of ten topotypes 41.1); digit III, metacarpal 37 (average of ten topotypes 37.9); first phalanx 12 (average of ten topotypes 12.1); second phalanx 16 (average of ten topotypes 16.8); tibia 18 (average of ten topotypes 18.6).

Skull: greatest length 15.6 mm.; basal length 12.5; palatal length 7; zygomatic breadth 8; interorbital constriction 3.4; mastoid breadth 9; width of brain case 7.6; upper tooth-row 6; lower tooth-row 6.2.

Remarks.—This small dark form from the Mexican highlands has till now been confused with *pallescens* of western United States. The series of skins at present available, however, shows that it is quite different in color, a very smoky appearing bat, nearly uniform in tint, with none of the buff or brown tones of *pallescens* or *townsendii*, nor the white belly of *macrotis*. In fall and winter pelage it seems to resemble *pallescens* more closely but is darker. It is odd that the accessory cusp of the inner upper incisor, usually wanting in other races of *megalotis*, should be normally present in *mexicanus*. In this respect it resembles *macrotis* of the southeastern United States, but otherwise shows no near approach to that species. It is further remarkable that the adults are indistinguishable in color from the immature individuals, which in other races are darker than the fully grown specimens.

I have provisionally considered all records of *Corynorhinus* from south of Chihuahua as referring to the present race, but the possibility that those recorded from Oaxaca or Vera Cruz may be still different is not to be overlooked. Through the kindness of Mr. C. D. Bunker of the University of Kansas Museum, I have before me a single speci-

men said to have been collected by George F. Gaumer on the Island of Cozumel, Yucatan. The skin had no original label and is apparently quite typical of *pallescens* so that it is more than likely the locality is erroneous.

For the privilege of describing this new form I am indebted to Mr. H. W. Henshaw, Chief of the Biological Survey.

Specimens examined.—Total number eighteen, from the following localities:—

Chihuahua: near Pacheco, 14 (Biol. Surv.).

Zacatecas: Valparaiso Mts., 2 (Biol. Surv.).

Jalisco: Guadalajara, 1 (Amer. Mus. Nat. Hist.).

Guanajuato: Sta. Rosa, 1 skull (Biol. Surv.).

The following additional locality records probably refer to this subspecies: San Luis Potosi, Hacienda la Parada; Michoacan, Patzcuaro; Oaxaca, Oaxaca; Vera Cruz, Jico (see Miller, 1897, p. 53).

CORYNORHINUS MACROTIS (LeConte).

LeConte's Big-eared Bat.

Plecotus macrotis LeConte, Cuvier's Animal kingdom, ed. McMurtie, 1831, 1, appendix, p. 431.

Plecotus lecontei Cooper, Ann. Lyc. nat. hist. N. Y., 1837, 4, p. 72, pl. 3, f. 5.

Synotus lecontei Wagner, Schreber's Säugethiere, suppl., 1855, 5, p. 720.

Vespertilio macrotis LeConte, Proc. Acad. nat. sci. Phila., 1855, p. 436 ("Georgia").

Synotus macrotis H. Allen, Smithsonian misc. coll., 1864, 7, no. 165, p. 63.

Corynorhinus macrotis H. Allen, Proc. Acad. nat. sci. Phila., 1865, p. 174.

Plecotus (Corinorhinus) macrotis Trouessart, Cat. Mamm., 1897, fasc. 1, p. 105.

Type.—None specified. A "dry" specimen, 4727 U. S. N. M., presented by Major LeConte, with locality entered as "United States," is listed by Harrison Allen in his Monograph of the Bats of North America, 1893. This specimen may well be the actual one on which LeConte based his description.

Type Locality.—No locality is mentioned in the original description. In a later paper, however, LeConte states (1855, p. 436) that it inhabits "Georgia," whence it is inferred that the type locality is "probably near the LeConte Plantation; 5 miles south of Riceboro," Liberty County, in that State (Miller, 1897, p. 51).

Distribution.—Southeastern United States, from North Carolina,

Georgia and (? northern) Florida, westward through the Southern and Gulf States, into Louisiana, and probably eastern Texas.

General Characters.—Distinguished from *megalotis* and its subspecies by the clear white tips to the belly hairs, and the contrasted brown tips and blackish bases of the hair of the back; inner upper incisor bicuspidate.

Color.—Adults: the basal two thirds of the hairs of the dorsal surfaces is 'plumbeous black,' the terminal third a uniform cinnamon-brown, practically 'saya brown,' in sharp contrast; beneath, the hairs are 'plumbeous black' basally, their tips *clear white*, again in sharp contrast. Specimens in thin pelage show much less of the cinnamon-brown above and the plumbeous bases of the hairs give a predominating dark appearance with a streaking of cinnamon; below, the white tipped hairs are less numerous particularly on throat and chest. The region at the posterior base of the ears is usually dark like the rest of the back, but in one specimen is whitish.

Immature individuals, though similar to adults in the contrasting dark bases and white tips of the hairs of the ventral surfaces, are much darker above, owing in part to the thinness of the pelage which allows the plumbeous bases of the hairs to show through, and in part to the paler (almost buffy) tipping of the contour hairs.

Skull.—Though essentially similar, the skull of *macrotis* differs from that of true *megalotis* and its race *pallascens* in being slightly smaller, and with a flatter profile. The intermaxillary notch is in general a trifle more contracted in dorsal view. The inner upper incisor of *macrotis* seems invariably to bear a small cusp on its exterior side, whereas in *megalotis* and *m. pallascens* this cusp is normally wanting, though in two out of twenty-eight specimens it was indicated, and in the race *mexicanus* is usually present.

Measurements.—No. 159413, Biol. Survey Coll., from Young Harris, Union County, Georgia: forearm 43.5 mm. (average of nine specimens 41.7); digit III, metacarpal 39.6 (average of nine 37.7); first phalanx 13.6 (average of nine 12.9); second phalanx 18 (average of nine 16.6); tibia 21.

Skull: greatest length 16.6 mm.; basal length 13.2; palatal length 7.3; zygomatic breadth —; interorbital constriction 4; mastoid breadth 9.5; width of braincase 8.5; upper tooth-row 6; lower tooth-row 7.

Remarks.—In its style of coloration this bat differs notably from *megalotis* and its races, though in structure it is very similar. Its smaller skull, and the constantly bifid inner upper incisor distinguish

it further from any of the forms occurring in the United States. I have found no evidence that it intergrades at any point with true *megalotis* or with *m. pallescens*. In North Carolina, a typical specimen in the collection of Mr. Morton L. Church, was captured at Marshall, in the extreme western end of the State, while from extreme western Virginia comes *megalotis*, without any sign of intergradation, though the localities are not far distant on opposite sides of the Alleghenies. Since writing the above, I have also examined a skin of *macrotis* from Mitchell, Ind., which is of interest as indicating not only the northward limit of the species' range in east central United States, but also that it keeps distinct from *megalotis* where the two occur together. Alcoholic specimens, if in good condition, show the white-tipped hair with its dark bases on the belly, and can usually be distinguished by this character. How far to the westward this bat ranges is as yet unknown. It is found in Louisiana and northward into Arkansas and Indiana but has not yet been discovered in eastern Texas although *pallescens* is recorded from western Texas. If this apparent hiatus shall prove to be real, it would indicate that the range of *macrotis* is fairly distinct from that of *megalotis* and its races. The present evidence therefore shows that *macrotis* constitutes a species distinct from the latter, though closely allied and of similar structure. It is characteristic of the Lower Austral life zone.

Specimens examined.—The following specimens have been studied, a total of nineteen.

North Carolina: Marshall, 1 (M. L. Church Coll.); ten miles northwest of Taylorsville, 2 (N. C. Coll. Agric.).

South Carolina: Society Hill, 2 (U. S. N. M.).

No locality, 2 (U. S. N. M.).

Georgia: Kesler, Early Co., 1 (M. C. Z.).

Young Harris, Union Co., 1 (Biol. Surv.).

? Riceboro, Liberty Co., 2 skulls (U. S. N. M.). These specimens were collected by LeConte, and though without record of locality, may have come from his plantation.

Alabama: Huntsville, 1 (Biol. Surv.).

Leighton, 1 (Biol. Surv.).

Louisiana: Houma, 4 (Biol. Surv.).

Arkansas: Osage River, 1 (M. C. Z.).

Indiana: Mitchell, 1 (Ind. Univ.).

In addition, it has been recorded from

Virginia: Dismal Swamp.

North Carolina: Bertie County; Goldsboro; Weaverville (Brimley, 1905, p. 22); Pisgah Forest, 3300 ft. (Oberholser, 1905, p. 9).

South Carolina: Hardeeville.

Florida: Micanopy.

Alabama: Greensboro.

Mississippi: Bay St. Louis.

CORYNORHINUS PHYLLOTIS, sp. nov.

Leaf-eared Bat.

Plecotus auritus J. A. Allen, Bull. M. C. Z., 1881, 8, p. 184 (not of Linné, 1758).

Type.—Skin and skull 5943, M. C. Z., collected by Dr. Edward Palmer, 24 March, 1878.

Type Locality.—Mexico: San Luis Potosi (probably near the city of the same name).

Distribution.—At present known from the type locality only.

General Characters.—Ears larger than in *megalotis*, the transverse ribs on the middle third of the outer edge subdividing and extending quite to the border; skull larger, the braincase inflated, and a distinct lachrymal ridge present; tips of hairs in sharp contrast with the dark bases; upper surface tawny olive; calcaneum with a well-developed keel.

Color.—Hair above long and silky; basal half dark, 'fuscous black,' the tips pale 'tawny olive'; a band of downy hair at the posterior base of the ears whitish. Below, the basal two thirds of the hairs is 'fuscous black,' the tips white, washed with 'pale ochraceous buff.' The distinct olive tone above is in marked contrast with the buffy or dark fur of the *macrotis* and *megalotis* coloration.

Skull.—This species is at once distinguished from the other species of the genus by its larger and differently shaped skull (Plate 1, fig. 6).

The braincase is flattened and broad, the rostrum broader and sharply depressed, with a more marked excavation medially; there is a distinct lachrymal ridge, as in *Plecotus*; the audital bullae are also larger. The teeth differ mainly in their stouter proportions, but the two upper incisors instead of being nearly side by side are one behind the other in the line of the tooth-row; there is also a greater disparity in size between the two anterior lower premolars, the first of which is much larger, in lateral view, than the second.

Measurements.—The type measures: forearm 44 mm.; digit III, metacarpal 42.4; first phalanx 14; second phalanx 16.3; digit IV, metacarpal 41.6; first phalanx 11.5; second phalanx 13.5; digit V, metacarpal 42; first phalanx 11; second phalanx 7; tibia 17; hind foot 10; ears (dry) from meatus 31; greatest breadth 21.

Skull: greatest length 17.5 mm.; basal length 14.9; palatal length 8.5; zygomatic breadth 10; interorbital constriction 4.8; mastoid breadth 10; width of braincase 9.6; upper tooth-row 7; lower tooth-row 7.1.

Remarks.—Though the type specimen was recorded thirty-five years ago, as *Plecotus auritus*, this remarkable species has remained till now unknown. The peculiar olive tone to the fur of the back is very different from the buffy or brown of the other known species. The very large and stiff ears are much like those of *Antrozous*, except for the breaking up of the transverse ribs at the middle of the outer margin. In this latter respect the ears recall those of *Plecotus*, in which also, the ribs run quite to the margin of the ear, instead of to a line parallel with the rim, as in other species of *Corynorhinus*. In *Plecotus*, however, the number of these ribs is about double that in *C. phyllotis*. The latter further resembles *Plecotus* in the possession of distinct lachrymal ridges on the skull, so that this character can no longer be considered of generic value in distinguishing between the two. A long narrow keel on the calcaneum is likewise diagnostic of this new bat, for in *Plecotus* as in other forms of *Corynorhinus* the calcaneum is without keel. In the squarish outline of the nostrils and the development of the excrescences on the muzzle it is typical of its genus. The peculiar bulging of the anterior part of the braincase is not seen in other members of this group. The tibia is proportionally shorter than in the smaller *C. megalotis mexicanus* which inhabits the same region.

Specimen examined.—The type.

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EXPLANATION OF THE PLATE.

EXPLANATION OF THE PLATE.

- Fig. 1.—*Corynorhinus megalotis townsendii*. 150273 Biol. Surv., upper incisors and canine of right side, with supernumerary incisor (i^3).
- Fig. 2.—*C. m. townsendii*. 204437 Biol. Surv. from McKenzie Bridge, Oregon, showing normal incisors (i^1 , i^2) and canine.
- Fig. 3.—*C. m. mexicanus*. 98285 Biol. Surv. Type, to show bicuspidate first incisor and weak canine.
- Fig. 4.—Ear of *C. megalotis*. 170933 Biol. Surv. from Sun City, Kansas.
- Fig. 5.—Ear of *C. phyllotis*. 5943 M. C. Z. Type, from San Luis Potosi, Mexico.
- Fig. 6.—Skull outline of *C. phyllotis*. 5943 M. C. Z. Type, from above.
- Fig. 7.—Skull outline of *C. megalotis mexicanus*. 98285 Biol. Surv. Type.

